Assignment 1

AI1110: Probability and Random Variables
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12.13.6.13: Question. Assume that the chances of a patient having a heart attack is 40%. It is also assumed that a meditation and yoga course reduce the risk of heart attack by 30% and prescription of certain drug reduces its chances by 25%. At a time a patient can choose any one of the two options with equal probabilities. It is given that after going through one of the two options the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga?

Answer: $\frac{14}{29}$.

Solution: According to the given question: the chances of heart attack is 40%.

Let:

A:	Person with heart attack
E1:	Person who is treated with meditation and yoga
E2:	Person who is treated with drug

$$\Pr(A) = 40\% = 0.40 \tag{1}$$

Also, the probabilities of meditation and yoga and drug is equal so.

$$\Pr(E_1) = \frac{1}{2}, \Pr(E_2) = \frac{1}{2} \tag{2}$$

In this question we have to find the probability of a person getting a heart attack and is followed with meditation and yoga. i.e. $\Pr(E_1|A)$

$$\Pr(E_1|A) = \frac{\Pr(E_1)\Pr(A|E_1)}{\sum_{i=1}^{2}(\Pr(E_i)\Pr(A|E_i))} \tag{3}$$

Now we have to find $\Pr(A|E_1)$ and $\Pr(A|E_2)$.

$\Pr(A|E_1)$ = Probability that a person getting a heart attack after being treated with meditation and yoga.

Meditation and yoga reduces the risk of a heart attack by 30%. There is still a 70% chance of heart attack.

$$\Pr(A|E_1) = 0.40 \times 0.70 = 0.28 \tag{4}$$

$\Pr(A|E_2)$ = Probability that a person getting a heart attack after being treated with drug.

Drug reduces the risk of a heart attack by 25%. There is still a 75% chance of heart attack.

$$\Pr(A|E_2) = 0.40 \times 0.75 = 0.30 \tag{5}$$

Using (3),(4) and (5)

$$\Pr(E_1|A) = \frac{\Pr(E_1)\Pr(A|E_1)}{\sum_{i=1}^{2}(\Pr(E_i)\Pr(A|E_i))} \tag{6}$$

$$= \frac{\frac{1}{2}X0.28}{\frac{1}{2}X0.28 + \frac{1}{2}X0.30} = \frac{0.28}{0.28 + 0.30} = \frac{0.28}{0.58} = \frac{14}{29} \tag{7}$$